

ERRATA

CHARLES RIVER CROSSING DSEIS/R July 1993

CENTRAL ARTERY/TUNNEL PROJECT

These pages contain corrections to the Charles River crossing Draft Supplemental Environmental Impact Statement/Report (DSEIS/R) for the Area North of Causeway Street, submitted July 30, 1993 to the Massachusetts Executive Office of Environmental Affairs and the U.S. Environmental Protection Agency in Washington, D.C. Minor corrections on tables are noted with an asterisk (*), which indicates this number has changed from the DSEIS/R. Corrected figures are completely replaced. Changes in text are indicated by grey shading, signifying an addition, and a ~~strike-through~~, indicating a deletion from the original text.

Tables 4.12, 4.13, and 4.14, included in this errata, completely replace and supersede those in the DSEIS/R. Table 4.12 shows corrected areas in square feet for right-of-way takings and easements, while taking data on Tables 4.13 and 4.14 have not changed. Minor edits have been made for the purpose of clarity.

In addition, the 3-page document entitled Scope of Work, Supplemental Environmental Impact Statement, Revised Charles River Crossing, included in this document, is the official Scope of Work issued by the Federal Highway Administration. It replaces the 4-page document entitled Federal Highway Administration Proposed Scope of Work included in Section 8.3.1, which is an earlier draft.

These pages supersede those contained in the DSEIS/R.



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- **Approach Of This DSEIS/R**

Inevitably, analysis of the Charles River crossing alternatives in light of the major environmental and transportation policy issues described above will identify competing concerns which need to be weighed against one another. This DSEIS/R seeks to present such analysis in an objective way, without assuming a preferred alternative. While recognizing that Scheme Z satisfies existing regulatory standards and the essential Project need, this DSEIS/R attempts to explore fully and fairly whether and how a reduction in the environmental and aesthetic impacts of the Charles River crossing may be achieved while continuing to meet Project regulatory and operational goals in the Area North of Causeway Street.

- **Summary Description Of Scheme Z And The Three New Design Alternatives**

Scheme Z. Scheme Z features three bridge structures: two cable-stayed bridges with towers on both sides of the Charles River, and a double-deck bridge differing in type and profile from the main bridge. There are no tunnels or ventilation buildings. The two cable-stayed bridges, each with five lanes in one direction, accommodate the I-93 mainline, while the double-deck bridge (three lanes over three) accommodates traffic movements to and from Leverett Circle/Storrow Drive, for a total of 16 lanes over the river. Viaduct structures in East Cambridge provide connections to Storrow Drive and Charlestown. Some traffic movements (I-93 northbound to Storrow Drive, and Storrow Drive to I-93 southbound) require motorists to cross the river twice. The dominant features of this design are the large bridge structures which have inconsistent profiles and six nested loop ramps in East Cambridge.

Alternative 8.1D Mod 5. Alternative 8.1D Mod 5 includes a 10-lane cable-stayed mainline bridge with a single twin-leg tower on the north side of the river, a single loop ramp in East Cambridge, a three-lane northbound tunnel under the river, and land tunnels under East Cambridge, the North Station commuter railroad tracks, and the Registry of Motor Vehicles building. Over 10,000 linear feet (lf) of structure are in tunnel, the greatest length of tunnel structure of any of the three alternatives. A ventilation building is required on the south side of the river to service the tunnel. I-93 mainline traffic crosses the Charles on a single bridge with four lanes in each direction. An additional two lanes on the western side of the mainline bridge carry I-93/Route 1 southbound traffic to Leverett Circle/Storrow Drive, for a total of 10 lanes over the river. The North Station area tunnel portion accommodates traffic between I-93 and Storrow Drive, and the tunnel under the Charles River accommodates northbound traffic between Storrow Drive, I-93 and Route 1 (Tobin Bridge).

Reduced River-Tunnel Alternative. This design incorporates revisions of 8.1D Mod 5 which address FHWA concerns about Leverett Circle traffic operations and the operational and safety issues posed by travel in the proposed river tunnel. The I-93 to Route 1 (Tobin Bridge) movement is taken out of tunnel and placed on a viaduct structure by adding two lanes to the mainline bridge. This reduces the amount of tunnel travel by approximately 4,000 lf to 6,150 lf. The 12-lane mainline bridge (four lanes each north and south, two lanes on the western side of the mainline carrying I-93/Route 1 southbound traffic to Leverett Circle/Storrow Drive, and two lanes on the eastern side carrying traffic from downtown and the Sumner Tunnel to I-93 northbound) is supported by two towers, one on each side of the river. There are two loop ramps in East Cambridge, and a two-lane northbound tunnel under the Charles River (carrying traffic from I-93 northbound to Storrow Drive), with a ventilation building on the north side of the river. The land tunnels under the North Station commuter railroad tracks (carrying traffic from Storrow Drive to I-93 southbound) require one ventilation building on the south side of the river.

Non-River-Tunnel Alternative. The Non-River-Tunnel Alternative takes Storrow Drive-to-Tobin Bridge traffic out of tunnel and places it on viaduct, resulting in an additional 3,000 lf reduction in the amount of tunnel. There are three loop ramps, reducing to two loop ramps in East Cambridge, and a total of 14

deck segment of the highway, approximately 1 mile to the north of the Charles River. To the north of the double-deck structure, the northbound and southbound mainline lanes are at the same elevation (side by side), which is required to effect the crossover of vehicles at the entrance and exit points to/from a contraflow lane.

Traffic Conditions. There is little need for a northbound HOV lane within the Project limits, independent of design constraints. Traffic forecasts indicate that northbound lanes within the Project limits will operate without substantial traffic delays. Therefore, a northbound dedicated HOV lane would provide negligible benefits for HOVs, and would not meet standard planning criteria. Speeds in the general-purpose lanes are forecast to be in the range of ~~45 to 50~~ 40 to 45 mph for the new design alternatives, from the Gilmore Bridge to the Project limits.

Approximately 2.3 miles to the north of the Project limits, however, a capacity constraint is forecast to occur on I-93 at the location of the Route 16 exit ramp. Queuing associated with this capacity constraint is forecast to extend upstream approximately 8,000 feet, substantially to the north of the Project limits.

4.1.6(c) Compatibility With Proposed HOV Facilities To The North Of The Project Limits

In the MHD report cited above, a contraflow lane, to be implemented through the use of moveable concrete barriers, is identified as the most feasible long-range option for providing an HOV lane on I-93 between the Charles River crossing and Route 128. This recommendation was developed in response to a Massachusetts air pollution control regulations (310 CMR 7.37) requiring the evaluation of an extension of the existing I-93 southbound lane northward toward Route 128, and the addition of a northbound HOV lane extending toward Route 128. HOV issues confined to the segment of I-93 within the Project limits were addressed in Sections 4.1.6(a) and 4.1.6(b). This section addresses issues affecting continuity between the design of the Charles River crossing and the proposed contraflow lane, which would be located to the north of the Project limits. These issues concern storage of a vehicle used for placement of moveable barriers, provision of an enforcement area, and transitions between facilities within and beyond the Project limits.

Southbound. The contraflow lane proposed to the north of the Project limits cannot be extended southward to the double-deck section of I-93 at the northern Project limits. The crossover between northbound and southbound lanes required at the contraflow lane entrance and exit cannot be incorporated in a double-deck roadway configuration. The contraflow lane begins and terminates, therefore, on the side-by-side segment of I-93 to the north of the Project limits. The only direct physical connection possible is in the AM peak period from the southbound contraflow lane (the left lane of the northbound direction, beyond the Project limits) to the southbound concurrent flow lane (within the Project limits, in the case of the three new design alternatives). The design of the HOV lane within the Project limits does not present any particular obstacles or constraints to establishing this connection, although the details of this transition need to be developed as part of the continuing design process. In a separate action, MHD has established a process for the coordination of Statewide HOV projects, including those planned for this Project and segments of I-93 to the north of the Project limits.

Northbound. In the northbound direction, physical connections between the Charles River crossing segment of I-93 and the contraflow lane do not represent a substantive concern, because there will not be a northbound HOV lane cannot be accommodated within the Project limits. An issue that could affect the design of the contraflow lane would be the weaving distance required between the general-purpose entrance ramps within the Project limits and the entrance to the contraflow HOV lane. A left-side diverge lane to the HOV entrance must begin at a point that will provide for safe weaving distances from the upstream entrance ramps, which would in effect control the location of the northbound contraflow lane

North Bank Transportation Corridor.

Affected Environment: Downstream from the North Point area is a historic transportation corridor which includes the MBTA commuter railroad tracks and bascule bridge, and the existing I-93 bridge. In the past, several more railroad bridges crossed the river in this area. Today, this area is constrained for future parkland development by the CANA City Square tunnel approaches, by the approaches to the pedestrian walkway over the railroad tracks, and by the Millers River outlet through culverts, where the granite seawalls are interrupted and the riverbank cuts inland. The four designs will compress this transportation-constrained area by moving the highway bridge toward the railroad crossing.

The MDC master plan proposes an "Arts Park" in the area next to and under the highway bridge, where environmental artworks, sculpture, and other works of art enhance and attract public use of this area, which is constrained by transportation structures in all alternatives. The master plan also proposes a park-related use such as a cafe in or around the historic railroad signal Tower A, which continues to operate the MBTA bascule drawbridge. While these details of future MDC programming as portrayed in the master plan would be MDC actions separate from the Project, they are suggestive of options which could result in viable future public use of this area as part of the overall regional park system.

Impacts: In Scheme Z, this transportation corridor is covered by ramps extending to the shoreline. A total of 400 lf of shoreline is covered, resulting in shadows that move laterally, affecting different parts of this area depending on the hour and season. Scheme Z has three separate bridges carrying 14 16 lanes; the one closest to the railroad bridge is double-decked. The northbound mainline bridge tower legs are located on shore and in the river; closer to the railroad bridge, four piers supporting the double-deck Storrow Drive connector bridge are located in the north bank area. These ramps and bridges have an adverse effect on the continuous path system along the north bank of the river, and extensive pedestrian improvements are proposed to address Scheme Z's impacts on this area. The Millers River and the proposed path from Rutherford Avenue are also covered by overhead viaduct.

Alternative 8.1D Mod 5 leaves this area comparatively open, although constrained by surrounding transportation structures, with the closest loop ramp 185 feet from the river's edge, and the single-span, 10-lane mainline bridge 230 feet downstream from the railroad crossing. This bridge is 170 feet wide and covers 220 lf of riverbank, leaving 280 lf of open riverbank next to the railroad crossing. Shadows move laterally, affecting most of this area during the morning. One leg of the bridge's double-pylon tower is on the riverbank, the other near shore in the river. The Millers River is covered in part by overhead viaduct and at-grade roadway; a successful path from Rutherford Avenue at this location continues to be difficult to achieve but the possibility is better than with Scheme Z because of Alternative 8.1D Mod 5's narrower viaduct.

The Reduced River-Tunnel Alternative has a single, 12-lane bridge that is 230 feet wide with both legs of its diamond tower on the riverbank. A stretch of 300 lf of riverbank is in shadow, which moves laterally, affecting this area during morning hours (this shadow is broken in two places by sunlight passing between the main bridge deck and the cantilevered lanes on the upstream and downstream sides). The riverbank between the railroad crossing and highway bridge is bounded by a loop ramp approximately 120 feet from the river. This open area has 280 feet of river frontage. The area is acceptable to pass through as part of the north bank path system. The Millers River and Rutherford Avenue path are covered in part by overhead viaduct and at-grade roadway.

The Non-River-Tunnel Alternative has a 10-lane mainline bridge downstream and a second, four-lane Storrow Drive connector bridge, 70 feet wide, located approximately 100 feet from the railroad bridge. This second bridge limits the open area available for programmed uses near Tower A. The width of this area from the river's edge to the first loop ramp is 120 feet, as in the Reduced River-Tunnel Alternative,

The value of these functions for the Charles River and the Millers River was then determined using this methodology. The analysis found that not all of the biological or chemical functions listed above perform at the highest level in either river. In some cases, they are performed poorly or not at all. Groundwater supply and surface water supply are nonfunctioning in both water bodies. Similarly, the natural flood storage and desynchronization function of both water bodies is low to nonexistent. While the Charles River provides an artificially controlled flood storage function, the water level of the river is controlled by the dam; thus it provides limited to no natural flood control. Because of the degraded overall quality of the aquatic resources and the presence of the Charles River dam, and highway and railroad bridges in this area, there are a limited number of functions performed by these water bodies.

Currently, there is almost no means of access by wildlife, except birds, to the Charles River and the adjacent Millers River, as the rivers and their narrow fringes of vegetation are entirely surrounded by industrial land. Disturbance from adjacent industrial land uses, poor water quality, and low-quality vegetation severely limit wildlife habitat suitability. The Charles River, because it contains fish, may serve as a feeding area for cormorants. The Millers River has low significance as a wildlife habitat.

Both rivers perform certain functions of nontidal wetland resources. Those functions which a water body or wetland perform well are termed principal valuable functions (PVF). The WRS agencies, during the development of the Projectwide Wetlands and Waterways Mitigation Program, established that PVFs would include only those functions and values that display a significance in any of the identified resources during existing baseline condition. Significance was determined by the agencies to include only those functions and values that received ratings of high or moderate during the evaluation of functions and values. Those functions and values that were rated low or nonfunctional are not included as PVFs. Based on those evaluations, the PVFs are as follows:

Charles River

sediment and shoreline stabilization
sediment/toxicant retention
nutrient retention and transformation
fish habitat

Millers River

sediment/toxicant retention
nutrient retention and transformation

Description Of Proposed Work. The permanent impacts evaluated in this DSEIS/R are based on a conceptual design and therefore it is not known where the exact location of piers, viaducts, tunnels, or at-grade ramps will be. Permanent impacts are shown in Table 4.39 and shown in Figures 4.30 through 4.37.

Scheme Z (see Figures 4.30 and 4.31) affects 0.10 acres of nontidal waters in the Charles River due to the placement of piers. This alternative also results in minor impacts to wetlands in the Millers River due to the placement of piers which displace less than 0.002 acres of wetlands and 0.01 acres of nontidal waters.

Alternative 8.1D Mod 5 (see Figures 4.32 and 4.33) places one pier in the Charles River. ~~This alternative also places bridge piers and fill in the Millers River for access ramps~~ displacing 0.010 acre of nontidal waters. ~~This alternative also places bridge piers and fill in the Millers River for access ramps~~. Approximately 0.20 acre of wetlands and 1.1 acres of nontidal waters will be lost in the Millers River. In this alternative, a tunnel will be placed under the mudline of the Charles River. This activity is not expected to have a permanent impact to Federal resource areas but will result in extensive temporary impacts resulting in disturbance of 1.9 acres of nontidal waters as described in Section 5.10.1.

Methodology. The State wetlands resource areas are delineated in accordance with the definitions as outlined in 310 CMR 10.00 and, except for Bordering Vegetated Wetlands (BVW), as described above according to elevation (see Appendix D). There are very little BVWs surrounding the Millers River. Three small, isolated areas of BVW are located on the west side and southern tip of the Millers River. These areas were delineated as BVW because they contain over 50 percent wetland vegetation, are low and flat, and have annually saturated soils. The wetland vegetation is dominated by reed grass. Interdispersion is low, which is typical of disturbed situations. No BVW are found along the Charles River. In both rivers, the top of the bank (el. 103.5 mean annual flood level) is less than midway up the steep slopes of the rivers and Bordering Land Subject to Flooding (BLSF) occurs as a narrow band between elevation 103.5 and 104.3, or 0.8 foot.

Presumptions Of Significance.

Bordering Vegetated Wetland: BVWs are likely to be significant to public or private water supply, groundwater supply, flood control, storm damage prevention, prevention of pollution, and protection of fisheries and wildlife habitat. In the case of the Millers River BVW, the presumptions of significance apply only for the prevention of pollution.

Banks: Banks are presumed to be significant to public or private water supply, to groundwater supply, to flood control, to storm damage prevention, to the prevention of pollution, and to the protection of fisheries and wildlife habitat. The banks in the Millers River are significant to the prevention of pollution only. Banks in the Charles River are significant to the prevention of pollution and to the protection of fisheries habitat.

Land Under Water Bodies And Waterways: Land Under Water Bodies and Waterways (LUW) is likely to be significant to public and private water supply, to groundwater supply, to flood control, to storm damage prevention, to prevention of pollution, and to protection of fisheries and wildlife habitat. LUW in the Millers River is significant to the prevention of pollution only. LUW in the Charles River is significant to the prevention of pollution and to the protection of fisheries habitat.

Bordering Land Subject To Flooding: BLSF is likely to be significant to flood control and storm damage prevention; however, because the water levels in the Charles River and the Millers River are controlled by the existing MDC dam, the water bodies have no function in terms of providing natural flood control. Because the Charles River is confined by vertical seawalls in this area and surrounding terrain is low and flat, there is no BLSF resource (see Appendix D). Although the Millers River has a constricted outlet and can store stormwaters, the presence of the Charles River dam and basin overrides any flood storage/storm damage protection functional value in the Millers River.

Impacts. The impacts to each wetlands resource area by alternative are shown in Table ~~XXX-55~~ and described as follows:

Banks: In the Charles River, the alternatives result in minor alterations to the bank from the bridge piers. Scheme Z affects 40 linear feet of bank in the Millers River as a result of pier placement. The three design alternatives result in a permanent loss of approximately 1,200 lf of bank because of fill in and along the Millers River for access ramps.

BVW: There is no permanent impact.

LUW: Impacts to LUW are associated with pier placement.

View Of And From The Road.

Viaducts: The Reduced River-Tunnel Alternative has 12 lanes of traffic on a single bridge structure crossing the Charles River, approximately 230 feet in width including gaps between the main line structure and the cantilevered lanes. ~~There are no piers in the water.~~ Four lanes in two loop ramps carry traffic between City Square and I-93. Two lanes of traffic (Ramps N-S and S-N) on one loop ramp connect Storrow Drive to I-93 northbound and southbound. One long-span bridge is supported by two diamond shape towers, approximately 310 feet high, located on the north and south banks. There are approximately 6,300 lf of tunnels through river and land. the longest section of tunnel is approximately 3,750 lf (to City Square and I-93 northbound).

Surface Roads: In the Martha Road/Lomasney Way corridor, Martha Road retains its existing appearance. At Leverett Circle and Lomasney Way/Nashua Street the corridor includes a more complex intersection of arterial roads and driveways than in Scheme Z; and has more tunnel. The 210-foot-wide corridor has more Project-related viaducts, tunnels, and transitional surface roads than Scheme Z, in addition to the MBTA Green Line. It is less likely than Scheme Z to warrant a pedestrian amenity except at areas that front buildings, or where tunnel egress stairs are required. The surface roads provide strong orientation to the surrounding neighborhoods.

The service roads connecting to Rutherford Avenue occur in an existing industrial area which they generally enhance with landscape design; except at the Millers River, which is partially filled to support surface roads.

Tunnels: The visual experience travelling to Charlestown includes some 500 feet in boat section prior to entering the new CANA ramps. Motorists view the tunnel interior followed by orientation with the visible surroundings of the north bank, prior to the CANA ramp in tunnel. Motorists travelling north on I-93 experience a gradually ascending path from the tunnel under the Charles River to viaduct. At tunnel curves, sight shelves enable views of traffic ahead. The surfaces of the tunnel, lighting, and signs are designed primarily to facilitate driver safety and comfort. The highway and highway elements inside the tunnel are compatible with highway elements of the surrounding areas.

Waterways. As proposed in the MDC parkland master plan, the Charles River has a reconfigured shoreline. This allows the bridge piers to have a foundation on the north bank, which narrows the Charles River at this point. There are no adverse visual impacts on the water environment due to viaduct piers. The I-93 bridge passes between 23 and 65 feet above the Charles River, casting shadows on the water. It is physically grouped into northbound and southbound lanes, separated by 4 feet. Ramps SA-CN and N-S are also separated east and west of I-93, by 10 feet. The shadows of the elevated viaduct are separated by daylight into four sections. This improves the visual experience of the water environment below. The separated lanes of I-93 have a regular and systematic design of highway elements, including the viaduct underdeck, which also enhances views from the water environment.

Parkland. This alternative has four fewer lanes on viaduct than Scheme Z and its piers have manageable impacts on the parkland. Viewed from the highway, the parkland is not hidden from view. It may be necessary to locate tunnel egress stair headhouses in the parkland.

Pedestrians on the north bank have views between North Point and Paul Revere Landing Park North, which, due to consistent profiles of loop ramps, is similar to Alternative 8.1D Mod 5. The proposed parkland and sculpted shoreline, however, add a pedestrian scale and facility to this environment, including a public interest attraction at the bridge piers. Pedestrians on the south bank have views between the MBTA railroad tracks and Lovejoy Wharf. A remodeled shoreline adds bridge abutment

architecture to their view. The separation of I-93 from Ramps S-N/N-S on the west creates two distinctive visual zones.

Project-Related Buildings. The tunnels in this alternative require one ventilation building on each side of the Charles River. Tunnel egress stair headhouses are also required.

The ventilation building on the south bank is built below ground except for an air-intake shaft and three exhaust-air discharge stacks. These have a visual presence due to their height when viewed from the area of the Charles River crossing. Views from the high-rise buildings on the south are partially interrupted by the stacks.

The top of ventilation building 9 is 60 feet above ground, with two exhaust-air discharge stacks, alongside I-93. The building is separated from the parkland by Ramp T-C among other industrial land uses. Ventilation building 9 is built on the north bank, alongside but lower than I-93. It is designed to complement the orientation of motorists, especially those travelling southbound. It has exhaust-air discharge stacks above the deck of I-93, which are visible from most areas of the Charles River parkland. The tunnel egress stair headhouses are being designed to respond to the recreational activity of the park. The opportunities to incorporate these structures into recreational uses in the park are being studied.

4.9.2(d) Non-River-Tunnel Alternative

The visual impacts of viaducts in this alternative are lessened by the separation of the two bridges. This reduces shadows on the parkland, and visually separates the cable-stayed bridge from the viaduct as two structural systems allowing the bridge to stand alone, relatively uncluttered. In other areas, appearances are similar to those described for the Reduced River-Tunnel Alternative, without the added impacts of a tunnel journey. The parkland areas are enlivened by implementation of the proposed MDC parkland master plan.

View Of And From The Road. The Non River-Tunnel Alternative has 14 lanes of traffic on viaducts crossing the Charles River, approximately 330 feet in width including a 100-foot gap between the mainline bridge and the bridge carrying Storrow Drive connections. Five lanes of traffic on three loop ramps carry traffic between City Square and I-93. Four lanes in two loop ramps (Ramps N-S and S-N) connect Storrow Drive to I-93 northbound and southbound.

This alternative has one 10-lane long-span bridge supported by two diamond shape towers, approximately 310 feet high on both north and south banks. A second 4-lane medium span parallel to the mainline bridge is supported by ~~four~~ five piers in the water. There are approximately 2,850 lf of land-based tunnels on the south bank of the Charles River.

Viaducts: Views are possible along the Charles River, and northeast and northwest to Charlestown and Somerville. The Storrow connector viaduct, which is approximately 100 feet west of I-93 and similar in profile, is not as high as the two-tier Scheme Z. The elevated views for motorists from it are wide, with less interruption from other viaducts and viaduct structures than in Scheme Z. Viaduct underdecks are visible to motorists and to park users, and their design is visually consistent with the highway and the highway elements.

This alternative has less than half the number of loop ramps than Scheme Z. Their impact, however, is reduced by their lower height, simpler pier design, and overall coordination as concentric ramps at approximately the same profile. In addition, the loop ramps maintain a 100-foot setback from the Charles River. In the area adjacent to North Point they are not as complex as the multilevel ramps of Scheme

4.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The implementation of Scheme Z or any of the three new design alternatives involves the permanent commitment of resources. This section discusses the natural, physical, and fiscal resources that are committed in the Area North of Causeway Street, and the relationship of the Project to other projects, existing or planned, in the subarea. The resources expended for the Project as a whole, and its relationship to projects in other subareas, are detailed in the 1991 FSEIS/R and are not repeated here.

4.12.1 Commitment Of Resources

The resources are being committed to the Project in the Area North of Causeway Street so that the Central Artery/Tunnel Project can be completed to improve the quality of the regional transportation system. Benefits will consist of improved accessibility, savings in travel time, and greater availability of quality services which outweigh the commitment of these resources.

Onetime Expenditure. Construction, right-of-way acquisition, and environmental mitigation for any of the four designs will require a substantial expenditure of State and Federal funds which are not retrievable. Construction of any one of the three new design alternatives to Scheme Z will add to the estimated amount. These estimated costs, in August 1993 dollars, are as follows:

Scheme Z	\$ 489 million
Alternative 8.1D Mod 5	\$1,282 million
Reduced River-Tunnel Alternative	\$1,131 million
Non-River-Tunnel Alternative	\$ 995 million

Raw Materials. Considerable amounts of labor, fossil fuels, British thermal units (Btu), and highway construction materials such as cement, aggregate, bituminous material, and steel will be expended in constructing any one of the four designs. In addition, large amounts of labor and natural resources are used in the fabrication and preparation of the designs. The total energy expenditures in the construction of the four designs are not retrievable.

Land/Building Acquisition. The permanent acquisition of land is required for the Charles River crossing. The following figures are approximate acreages:

Scheme Z	18 acres
Alternative 8.1D Mod 5	25.4 acres
Reduced River-Tunnel Alternative	25.5 acres
Non-River-Tunnel Alternative	29 acres

The above acreages do not include Boston and Cambridge city streets or MHD-owned property. In addition, under the new design alternatives, the Anelex building, and the Boston Thermal Energy Corporation's Minot Station are displaced. The Spaulding Rehabilitation Hospital will be taken. With all alternatives, acquisition of a portion of a private contractor's storage building is necessary; and there is some impact to two outdoor athletic facilities of Bunker Hill Community College, requiring their reconfiguration.

Air Rights. The development of air rights above the Project right-of-way is not precluded. The Non-River-Tunnel Alternative affects development of the air rights garage planned by the MBTA over the railroad tracks north of the new Boston Garden development.

Table 4.11**Comparison Of Property Takings By Design**

	Scheme Z	Alternatives		
		8.1D Mod 5 ¹	Reduced-River-Tunnel ¹	Non-River-Tunnel ¹
Number of permanent partial takings	24 parcels	*25 parcels	27 parcels	26 parcels
Number of permanent full takings	3 parcels	4 parcels	6 parcels	5 parcels
Total parcels affected by permanent takings	27 parcels	*29 parcels	33 parcels	31 parcels
Total area of permanent takings	777,581 sf	*1,104,191 sf	1,081,811 sf	1,244,021 sf

¹ These takings do not include the easements for the CANA connections acquired in 1986, nor the fee takings necessary for the surface street intersection to be located northerly of the O'Neill Federal Building. A fee taking is acquisition of all ownership rights to the parcel.

Source: Bechtel/Parsons Brinckerhoff

Table 4.12

**Right-of-Way/Land Ownership
Alternative 8.1D Mod 5**

Permanent Takings (approx. sf)						
Parcel No.	Property Owner	Current Use	P/F**	Fee Taking	Underground Highway Easement	Overhead Highway Easement
4	MHD*	office/parking				
2	MDC*	parking	P	.		23,940
3	MHD*	roadway/highway				
4	Millers River*	roadway/highway	F	62,080		
5	MHD*	Beverly Street parking				
6	Mass. General Hospital .	parking	P	56,120		
7	MBTA*	tracks/platforms	P		39,060	3,570
4	Boston Sand & Gravel	sand/gravel operations	P	90,830		12,330
12	MBTA*	railroad track area	P	44,330		69,640
11	MDC*	Charles/Millers Rivers				108,020
12	Boston Sand & Gravel	sand/gravel operations	P			35,270
13	MBTA*	railroad track area	P			14,580
12	MHD*	highway (proposed)				
19	Boston & Maine Corporation	warehouse	P		9,520	
12	MHD*	sewer plumbing/chl sta	P			18,570
17	Boston & Maine Corporation	light industrial	P			25,690
12	DCPO*	office/institutional	P	33,780	19,020	
19	MDC*	roadway	P	15,251		
20	MDC*	Leverett Circle (MBTA station above)	F	27,900		
21	MBTA*	railroad track area	P			290
22	MBTA*	access road	P			270
24	Charles River Park "A" Co.	landscaped area				
24	Whittier Pl. Condo Trust	landscaped area				
25	MDC*	pedestrian access				
26	Chardon Realty Trust ¹	parking/wharf	P			
27	Boston Thermal Energy Corp.	steam plant	F	15,270		
28	MHD*	highway/maintenance				
29	MHD*	highway/maintenance				
30	MDC*	police station/parking	P	18,830		
31	MDC*	pedestrian access				

¹ Extent of acquisition uncertain at this time.

Table 4.12 (cont.)

**Right-Of-Way/Land Ownership
Alternative 8.1D Mod 5**

Parcel No.	Property Owner	Current Use	P/F	Fee Taking	Underground Highway Easement	Overhead Highway Easement
32	MHD*	highway				
33	Millers River*	roadway/highway	P			42,230
34	MHD*	highway (proposed)				
35	BRA	parking	P	9,820	15,670	
36	Bunker Hill Comm'ty College*	college	P	29,560		70,170
39	Boston & Maine Corporation	street				
40	Gerald D. Conway, et al	commercial	P			6,210
43	BRA	commercial	P	1,960		
44	owner unknown	street	P			
45	MDC*	Charles River			51,610	
46	DCPO*	parking/heliport	P		34,870***	
56	The Spaulding Rehab. Hospital Corp	rehabilitation hospital	P	39,610	4,140	
58	Leed Realty Trust	commercial				
59	North Shore Realty Trust	commercial	P		24,660	
60	MBTA*		P			29,520

* Commonwealth of Massachusetts

** P = Partial; F = Full

*** underground easement for ventilation system duct not included

Source: Bechtel/Parsons Brinckerhoff

Table 4.13

**Right-of-Way/Land Ownership
Reduced-River-Tunnel Alternative**

Permanent Takings (approx. sf)						
Parcel No.	Property Owner	Current Use	P/F**	Fee Taking	Underground Highway Easement	Overhead Highway Easement
1	MHD*	office/parking				
2	MDC*	parking	P			25,200
3	MHD*	roadway/highway				
3	Millers River*	roadway/highway	P	62,080		
5	MHD*	Beverly Street parking				
6	Mass. General Hospital	parking	P	11,200	32,120	
7	MBTA*	tracks/platforms	P		37,130	5,080
9	Boston Sand & Gravel	sand/gravel operations	P	93,600		12,180
10	MBTA*	railroad track area	P	42,150		72,150
11	MDC*	Charles/Millers Rivers	P			140,980
13	Boston Sand & Gravel	sand/gravel operations	P	11,290	11,160	33,950
14	MBTA*	railroad track area	P		950	25,330
14	MHD*	highway				
15	Boston & Maine Corporation	warehouse	P		1,290	300
16	MDC*	sewer plumbing/chl sta	P			10,160
14	Boston & Maine Corporation	light industrial	P			42,840
18	DCPO*	office/institutional	P	33,730	14,860	
15	MDC*	roadway	F	15,251		
20	MDC*	Leverett Circle (MBTA station above)	P	27,900		
23	MBTA*	railroad track area	P			690
23	MBTA*	access road	P			850
29	Charles River Park "A" Co.	landscaped area	P	10,820		
23	Whittier Pl. Condo Trust	landscaped area	P	8,890		
23	MDC*	pedestrian access	P	2,660		
23	Chardon Realty Trust ¹	parking/wharf				
27	Boston Thermal Energy Corp.	steam plant	F	15,270		
28	MHD*	highway/maintenance				
29	MHD*	highway/maintenance				
30	MDC*	police station/parking	P	18,830		
31	MDC*	pedestrian access	F	4,010		

¹ Extent of acquisition uncertain at this time.

Table 4.13 (cont.)

**Right-Of-Way/Land Ownership
Reduced-River-Tunnel Alternative**

Parcel No.	Property Owner	Current Use	P/F	Fee Taking	Underground Highway Easement	Overhead Highway Easement
32	MHD*	highway				
39	Millers River*	roadway/highway	F	2,110	3,650	42,180
34	MHD*	highway				
36	BRA	parking	P	9,820		
36	Bunker Hill Comm'ty College*	college	P	29,560		65,790
39	Boston & Maine Corporation	street				
40	Gerald D. Conway, et al	commercial	P			6,210
43	BRA	commercial	P	1,960		
46	MDC*	Charles River	P		49,460	
46	DCPO*	parking/heliport	P		11,590	
56	The Spaulding Rehab. Hospital Corp.	rehabilitation hospital	P		1,350	
58	Leed Realty Trust	commercial				
58	North Shore Realty Trust	commercial				
60	MBTA*	railroad tracks	P			33,230

* Commonwealth of Massachusetts

** P = Partial; F = Full

Source: Bechtel/Parsons Brinckerhoff

Table 4.14

**Right-of-Way/Land Ownership
Non-River-Tunnel Alternative**

Permanent Takings (approx. sf)						
Parcel No.	Property Owner	Current Use	P/F**	Fee Taking	Underground Highway Easement	Overhead Highway Easement
1	MHD*	office/parking				
2	MDC*	parking	P	7,310		17,890
3	MHD*	roadway/highway				
4	Millers River*	roadway/highway	F	62,080		
5	MHD*	Beverly Street parking				
6	The Mass. General Hospital	parking	P	43,810	34,280	
4	MBTA*	tracks/platforms	P		35,220	39,390
4	Boston Sand & Gravel	sand/gravel operations	P	102,450		9,350
10	MBTA*	railroad track area	P	40,460		73,990
11	MDC*	Charles/Millers Rivers	P			177,010
12	Boston Sand & Gravel	sand/gravel operations	F			64,070
10	MBTA*	railroad track area	P			34,540
10	MHD*	highway				
15	Boston & Maine Corporation	warehouse	P			1,950
10	MDC*	sewer plumbing/chl sta	P			20,340
10	Boston & Maine Corporation	light industrial	P			58,430
10	DCPO*	office/institutional	P	59,740	10,990	
15	MDC*	roadway	F	15,251		
20	MDC*	Leverett Circle (MBTA station above)	F	27,900		
21	MBTA*	railroad track area	P			2,510
20	MBTA*	access road	P			1,850
23	Charles River Park "A" Co.	landscaped area	P	9,800		
24	Whittier Pl. Condo Trust	landscaped area	P	8,840		
25	MHD*	pedestrian access	P	2,660		
25	Chardon Realty Trust ¹	parking/wharf				
27	Boston Thermal Energy Corp.	steam plant	F	15,270		
20	MHD*	highway/maintenance				
20	MHD*	highway/maintenance				
30	MDC*	police station/parking	P	18,850		
31	MDC*	pedestrian access	P	3,010		

¹ Extent of acquisition uncertain at this time.

Table 4.14 (cont.)

**Right-Of-Way/Land Ownership
Non-River-Tunnel Alternative**

Parcel No.	Property Owner	Current Use	P/F	Fee Taking	Underground Highway Easement	Overhead Highway Easement
32	MHD*	highway				
39	Millers River*	roadway/highway	F	4,680		43,270
34	MHD*	highway				
45	BRA	parking	P	9,700		
36	Bunker Hill Comm'ty College*	college	P	29,560		65,790
39	Boston & Maine Corporation	street				
40	Gerald D. Conway, et al	commercial	P			6,210
43	BRA	commercial	P	1,960		
45	MDC*	Charles River				
45	DCPO*	parking/heliport	P	11,010		
56	The Spaulding Rehab. Hospital Corp.	rehabilitation hospital	P	39,370		
58	Leed Realty Trust	commercial				
58	North Shore Realty Trust	commercial				
60	MBTA*	railroad tracks	P			33,230

* Commonwealth of Massachusetts

** P = Partial; F = Full

Source: Bechtel/Parsons Brinckerhoff

Table 4.16

NATIONAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period	Primary ($\mu\text{g}/\text{m}^3$)	Primary (ppm)	Secondary ($\mu\text{g}/\text{m}^3$)
Carbon Monoxide (CO)	8-hour ^a	10,000	9.0	10,000
	1-hour ^a	40,000	35.0	40,000
Sulfur Dioxide (SO ₂)	Annual	80	0.03	1,300
	24-hour ^a	365	0.14	
	3-hour ^a			
Nitrogen Dioxide (NO ₂)	Annual	100	0.05	100
Ozone (O ₃)	1-hour ^b	235*	0.125	235
PM ₁₀	Annual	50		50
	24-hour ^a	150		100
Lead (Pb)	3-month	1.5		1.5

Notes: a. Not to be exceeded more than once per calendar year.

b. Not to be exceeded more than one day per calendar year.

c. The MDEP has established a 1-hour guideline level of 320 $\mu\text{g}/\text{m}^3$ for NO₂.

Sources: EPA, National Primary and Secondary Ambient Air Quality Standards (40 CFR 50).
Massachusetts DEP, Massachusetts Ambient Air Quality Standards (Title 310), April 20, 1978.

Table 4.26

VENTILATION BUILDING DESIGN PARAMETERS

Bldg. No.	Alternative	Stack Height (m)	Exit Velocity (m/s)	Stack Effective Diameter (m)/exhaust vent*
8	8.1D Mod 5 (above ground)	100.6	7.62	6.86
8	Non-River-Tunnel (under ground)	100.6	7.62	5.22
8	Reduced River-Tunnel (under ground)	97.5	7.62	5.32
9	Reduced River-Tunnel (above ground)	32.0	7.62	5.32
1		41.1	8.13	10.07
3		73.2	8.13	13.08
3		38.1	8.13	13.70
5		38.9	8.13	12.38
6		27.7	8.13	8.64
7		32.0	8.13	13.20
Bldg. No.	Alternative	Width (m)	Length (m)	Height (m)
8	8.1D Mod 5	38.9	38.4	18.3
9	Reduced River-Tunnel	12.6	34.2	18.3

*Notes: Vent effluent temperature assumed as ambient.

*Alternative 8.1D Mod 5 has 2 exhaust vents; each other alternative has 1 exhaust vent.

Source: Bechtel/Parsons Brinckerhoff

Table 4.42

COMPARISON OF VISUAL IMPACTS BY ALTERNATIVE

	Scheme Z	Alternatives Compared to Scheme Z		
		8.1D Mod 5	Reduced River-Tunnel	Non-River-Tunnel
Viaducts	<i>Adverse Impact</i> Sixteen-lane bridge crossing. Complex multilevel loop ramps. Two-tier 6-lane viaducts at North Station area. Interruption of views.	<i>Minimal Impact</i> Ten-lane bridge crossing. One loop ramp. One two lane viaduct at North Station area.	<i>Moderate Impact</i> Twelve-lane bridge crossing. Two loop ramps. One two lane viaduct at North Station area.	<i>Moderate Impact</i> Fourteen-lane bridge crossing. Two to three loop ramps. One four-lane viaduct at North Station area.
Surface environment	<i>Adverse Impact</i> Major encroachment on riverbank and North Point. MDC parkland plan accommodated.	<i>Moderate Impact</i> Proposed MDC parkland plan accommodated. Lomasney Way corridor is adversely affected. Large ventilation building at Spaulding site.	<i>Moderate Impact</i> Proposed MDC parkland plan accommodated. Lomasney Way corridor is adversely affected. Two smaller ventilation buildings (below ground on south bank; above ground on north bank; above ground stacks).	<i>Moderate Impact</i> Proposed MDC parkland plan accommodated. Lomasney Way corridor adversely affected. One below ground ventilation building on south bank with above ground stacks. Realigned Nashua Street.
Tunnel environment	<i>No Impact</i> Short underpass at Leverett Circle only.	<i>Adverse Impact</i> Extensive and complex tunnel system (curves, grades and decision points numerous).	<i>Moderate Impact</i> Simpler tunnel system.	<i>Minimal Impact</i> Least complex tunnel system.
Water environment (# piers in Charles reflects existing shoreline; not sculpted shoreline in proposed MDC master plan)	<i>Adverse Impact</i> 11 piers in Charles. 8 piers in Millers. Interruption of visual navigation. Major shadowing effects of bridge structure.	<i>Minimal Impact</i> One pier in Charles. 5* piers in Millers. Minimal shadowing effects of narrower bridge structure.	<i>Minimal Impact</i> 2* piers in Charles. 7* piers in Millers. Some shadow impacts due to bridge structure.	<i>Moderate Impact</i> 6 piers in Charles. 5* piers in Millers. Moderate shadow impacts due to two separate bridge structures.

Source: Bechtel/Parsons Brinckerhoff

Table 5.2**Preliminary Estimates Of Dredged Material Acceptable And Unacceptable For Ocean Disposal At The MBDS (in cubic yards)**

Design	Acceptable	Unacceptable
Scheme Z ^{1*}	41,000	10,000
8.1D Mod 5	138,000	30,000
Reduced River-Tunnel	119,000	26,000
Non-River-Tunnel	36,000	8,000

¹ All assumed unacceptable in the 1991 FSEIS/R; revised figures are based upon subsequent characterization.
Source: Bechtel/Parsons Brinckerhoff

5.3.1(b) Disposal Alternatives

Disposal alternatives for unacceptable dredged material were analyzed in the 1991 FSEIS/R (Part IIB, Chapter 4, Section 4.7). Disposal site alternatives are limited for unacceptable dredged material because of the material's chemical contamination, water content, and salt content. Disposal site alternatives analyzed included the unconfined ocean disposal at the MBDS, confined aquatic disposal (CAD) options such as Spectacle Island, Hull Bay, and the Logan Airport north and west borrow pit sites; and upland sites including Spectacle Island, the Neponset Drive-in/Hallet Street landfill, Squantum Point, Governors Island (Logan Airport), and the Lynn Harbor Transcontinental Development Corporation (TDC) site. The disposal option for the unacceptable dredged material in the 1991 FSEIS/R was upland disposal at Spectacle Island.

It is anticipated that unacceptable dredged material will not be heavily contaminated and could be used as fill within the Project area. This use would minimize truck or barge traffic. Unacceptable dredged material could be placed in the graving basin or Millers River and capped with clean fill. Stabilizing this material could make it suitable for disposal at other upland locations. Because a large volume of unacceptable dredged material will be removed early in the construction phase for the Reduced River-Tunnel Alternative and Alternative 8.1D Mod 5, a stockpile location may be required until the graving basin is decommissioned and filled. Potential stockpile locations include an MDC-owned parcel in the North Point area of East Cambridge and the railroad yards in Somerville.

Acceptable dredged material will be transported by barge and disposed of at the MBDS. The existing locks at the Charles River dam limit the size of barges which can pass through the locks. An ocean dump scow cannot traverse the locks; therefore, smaller deck barges will need to be used for transport of the dredged material through the locks. The dredged material would then be transferred from the deck barges to the larger ocean dump scow at a location in the Harbor outside of the Charles River basin. Alternatively, the dredged material could be loaded onto trucks at a location on the riverbanks and trucked to a barge loading location in the Harbor for loading onto an ocean dump scow. Because of the high water content of the dredged material, it would need to be dewatered prior to loading into trucks, or placed in watertight trucks for transport to the barge loading location.

The methods proposed for bridge construction address major sources of suspended solids (see Section 5.1.1). Suspended solids could affect the survivorship of larval fish which may not attain adequate nutrition while feeding on non-algal sediment. Because of the low flow and controlled depth of the Charles, a master pile/sheet pile arrangement (vertical excavation support) or silt curtains would be effective in controlling the dispersion of suspended solids from dredging, or from shoreline construction areas. Therefore, only minimal temporary impacts are expected during construction of Scheme Z and the three design alternatives. By controlling turbidity, fish movement would not be impeded, and would be restricted only from areas of dredging and pier construction. Because construction is planned so as not to prohibit navigation, it is expected that fish (including anadromous species) passage would not be affected by any alternative.

Alternative 8.1D Mod 5 and the Reduced River Tunnel Alternative may require blasting operations to construct the tunnel trench. The Charles River dam pool does not have the high flow rates which aid in dissipating underwater blast energy. The low flow in the Charles River will require implementation of stringent controls necessary to protect the diversity of fish found there year-round. Unlike the anadromous herring that were startled from blast areas by high frequency sound during the Third Harbor Tunnel construction, many of the other fish species have not responded to such protection devices. Other methods, however, have been used to deter fish from entering harmful locations, including behavioral stimuli such as strobe lights, pneumatic hammers, electric fields, and bubble curtains, and physical barriers such as nets, steel mesh, and silt curtains. In association with blasting controls a protection system using one or several measures could be developed to minimize the potential harm to fish. Physical barriers, because they are not species selective, may be the most effective measure to protect all species of the pool above the dam. Depending on overpressures generated by blasting, bubble curtains might be used to dissipate blast energy.

Under Scheme Z and the new design alternatives, acceptable dredged material is anticipated to be disposed at the Massachusetts Bay Disposal Site (MBDS) under the existing U.S. Army Corps of Engineers (USACE) permit. MHD in coordination with the USACE, will reinitiate the original Section 7 Consultation in accordance with the Endangered Species Act of 1973 (16 U.S.C. sec 1531 et seq.) to assure that additional quantities of dredged material can be disposed at the MBDS without affecting endangered or threatened species.

5.10.5 Water Quality

Scheme Z and the three new design alternatives require bridge and viaduct construction which would result in minimal water quality impacts. Each bridge pier is constructed within a cofferdam which will contain disturbed sediments.

Dredging and filling in the Charles and Millers Rivers for the tunnel, footings and roadways have limited localized effects on water quality depending on construction technique and mitigation measures used. To minimize the effects, the contractor will monitor water quality on a regular basis and use such turbidity control measures as turbidity curtains, a closed dredge bucket, and cofferdams. Upon completion of construction, levels of suspended particulates and turbidity are expected to return to normal levels.

As identified in the 1991 FSEIS/R, surface runoff and any excavation dewatering discharge to surface waters or reintroduced into the ground is regulated by DEP and EPA to meet water quality standards. The Project's construction NPDES permit requires site-specific plans for controlling and treating discharges. With those appropriate controls in place, all the alternatives would have minimal water quality impacts.



FIGURE

4.29

Federal Aquatic Resource Areas

Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 50 100 200 FEET



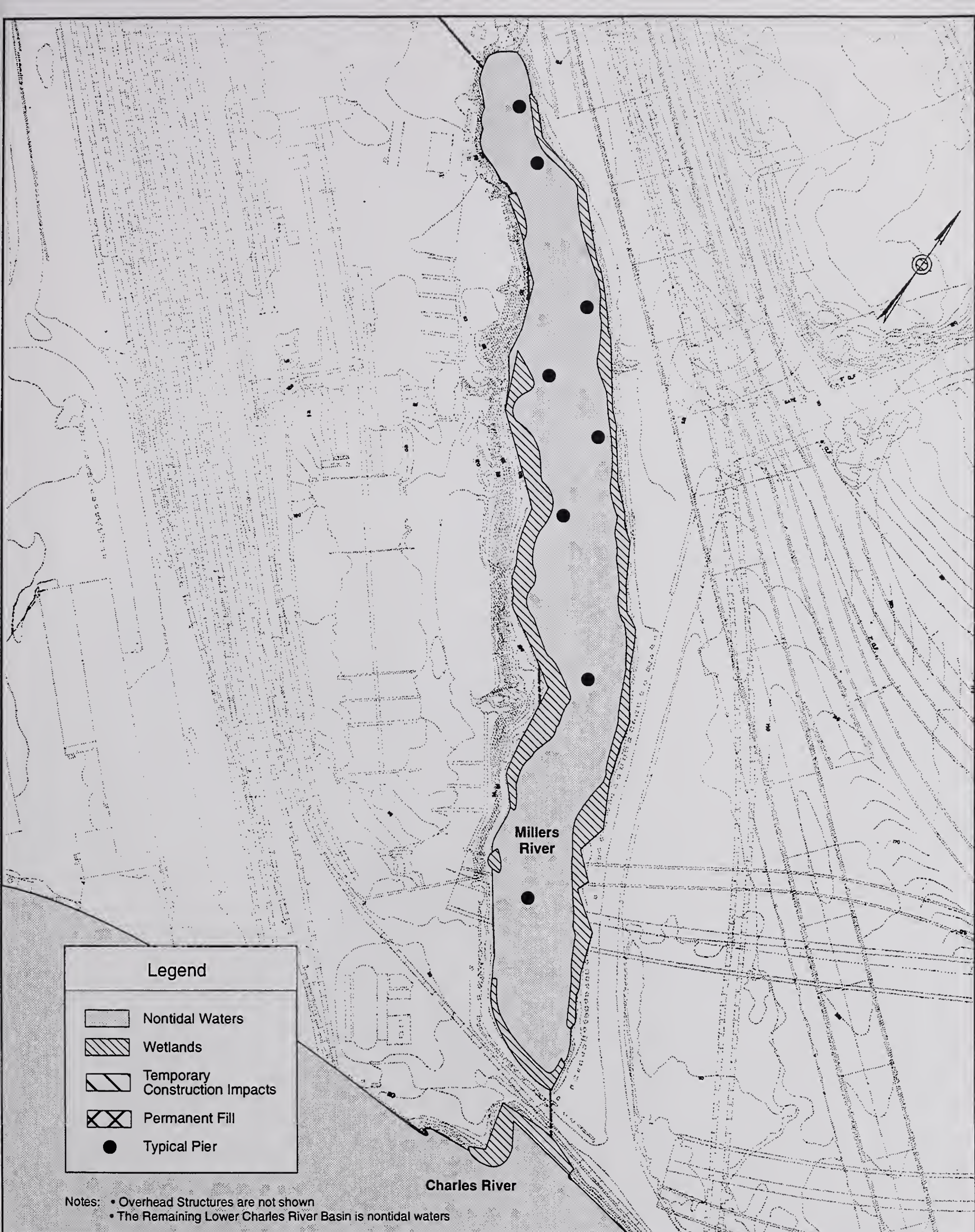
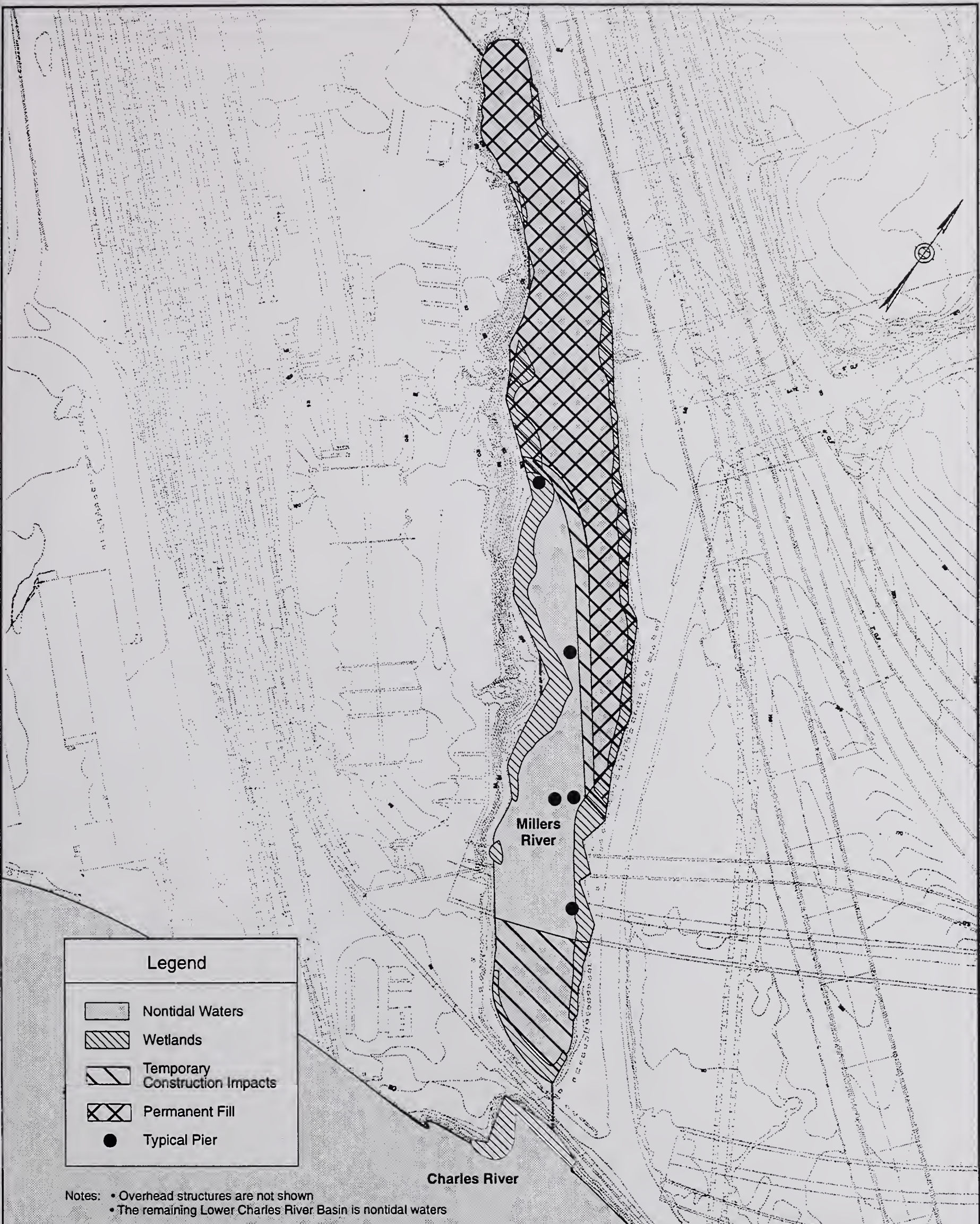


FIGURE
4.30

**Affected Federal Aquatic
Resource Areas; Millers River:
Scheme Z**
Charles River Crossing DSEIS/R



Legend

- Nontidal Waters
- Wetlands
- Temporary Construction Impacts
- Permanent Fill
- Typical Pier

Notes: • Overhead structures are not shown
• The remaining Lower Charles River Basin is nontidal waters

Charles River

Millers River

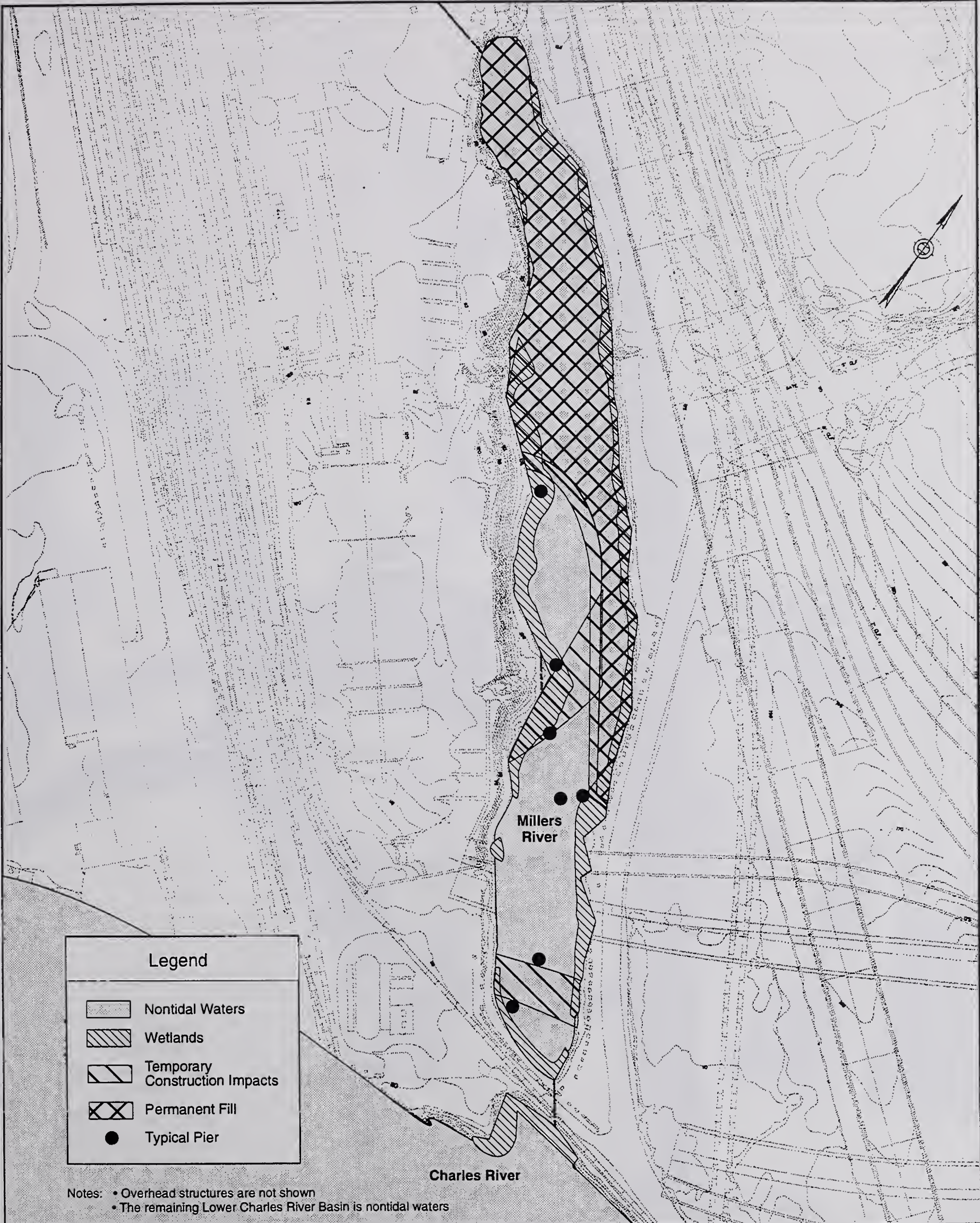
FIGURE
4.32

Affected Federal Aquatic
Resource Areas; Millers River:
Alternative 8.1D Mod 5
Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 50 100 200 FEET





Legend

-  Nontidal Waters
-  Wetlands
-  Temporary Construction Impacts
-  Permanent Fill
-  Typical Pier

Notes: • Overhead structures are not shown
• The remaining Lower Charles River Basin is nontidal waters

Charles River

Millers River

FIGURE
4.34

**Affected Federal Aquatic
Resource Areas; Millers River:
Reduced River-Tunnel Alternative**
Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 50 100 200 FEET



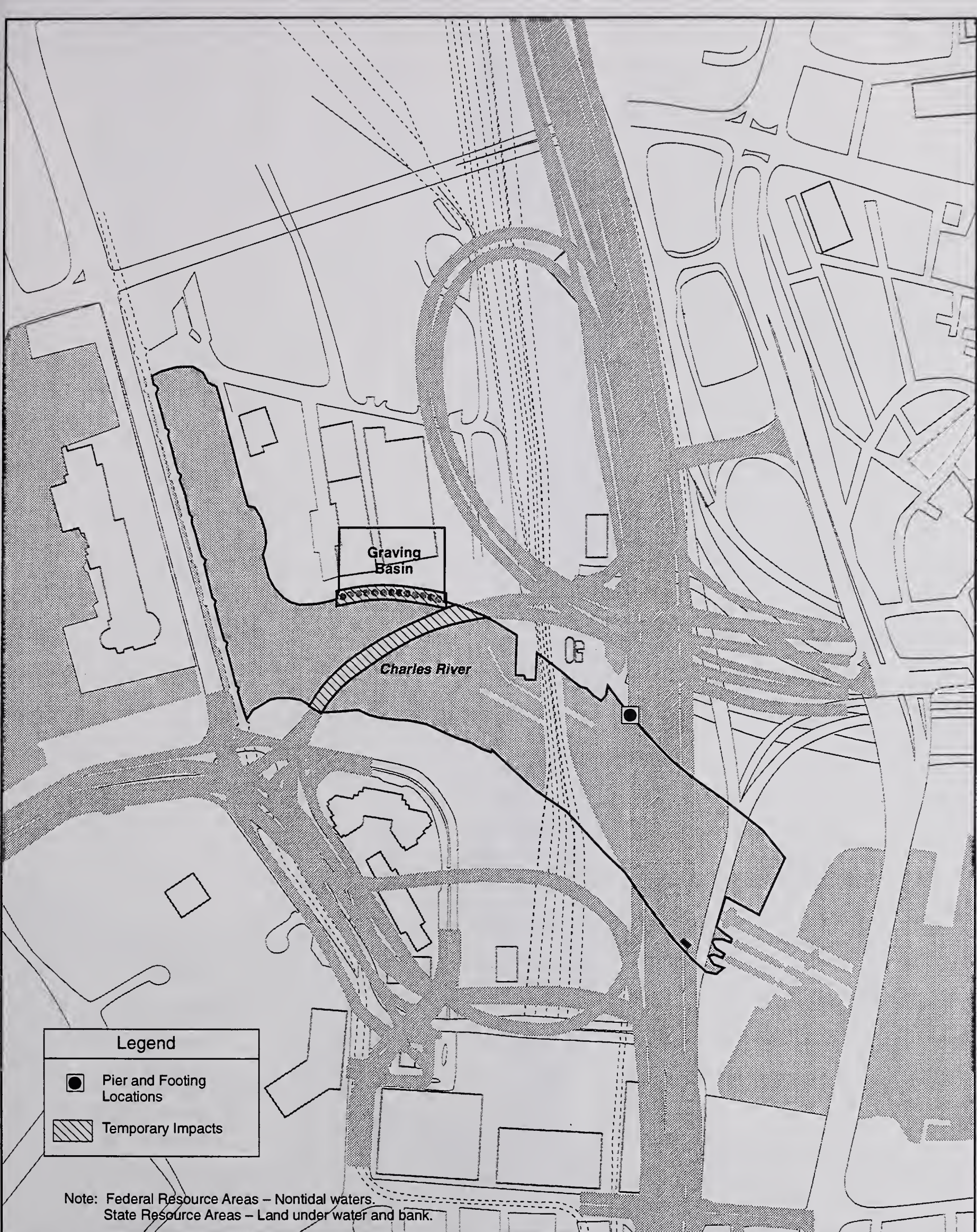


FIGURE
4.35

**Affected Aquatic Resource Areas;
Charles River:
Reduced River-Tunnel Alternative**
Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 200 400 600 FEET



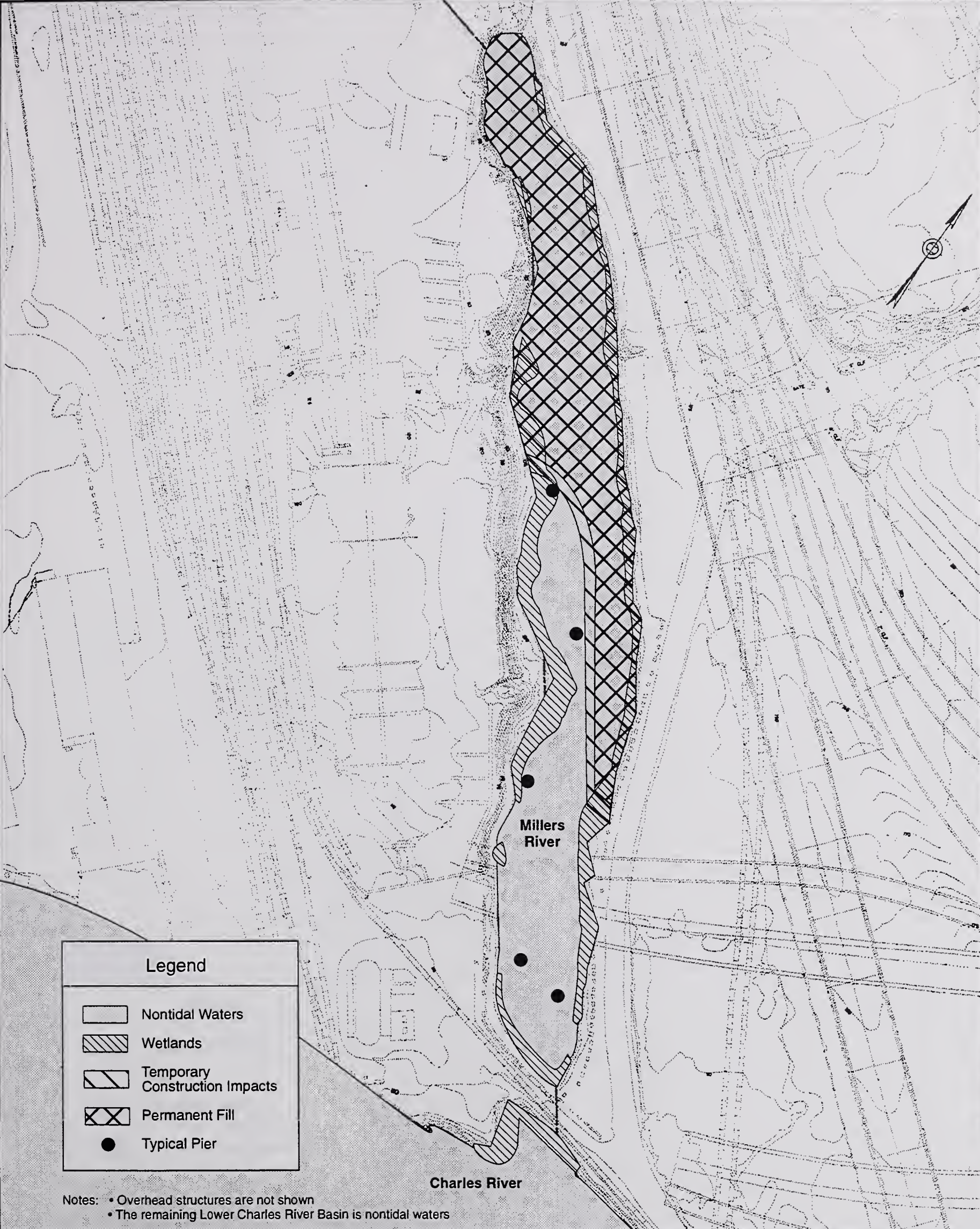
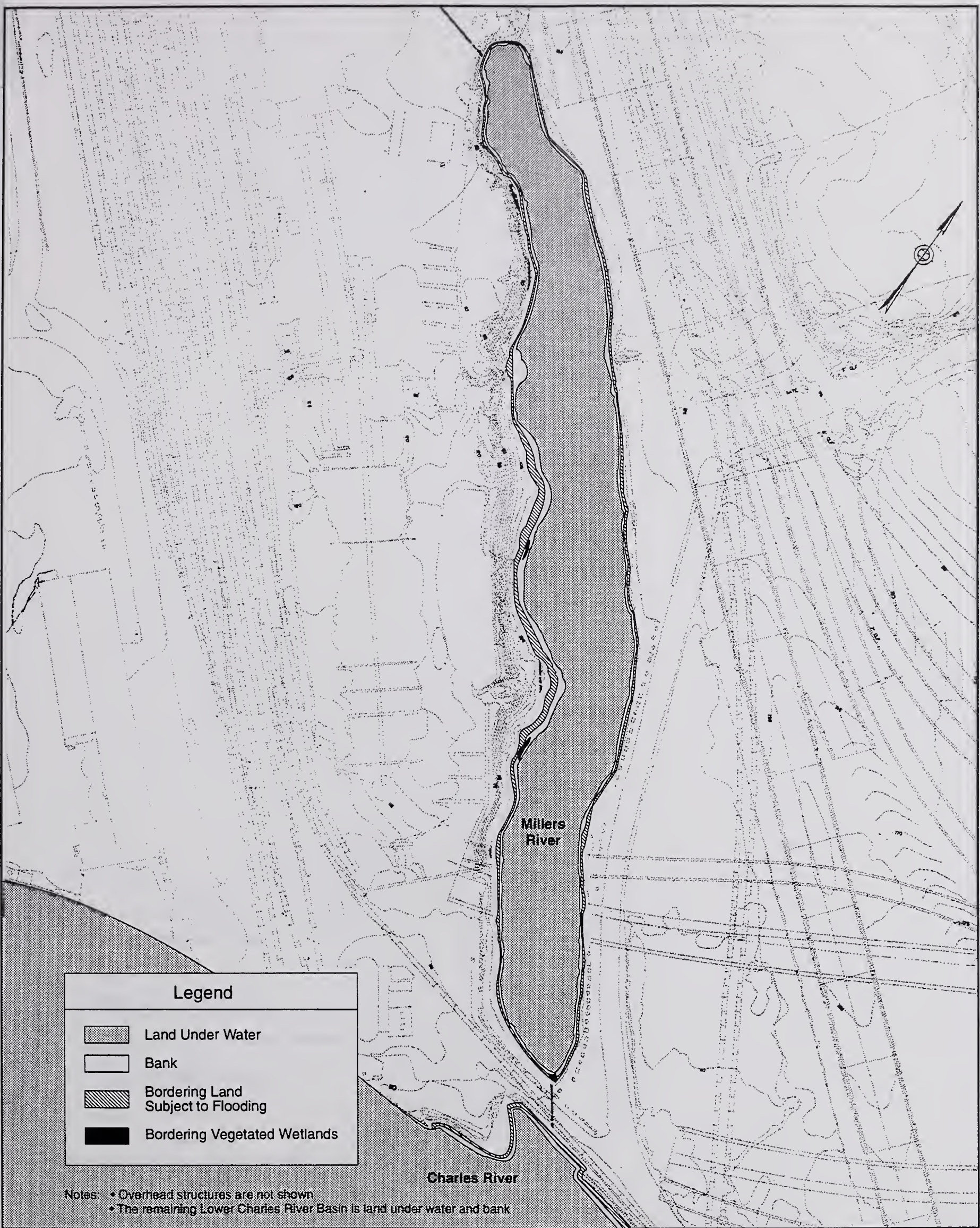


FIGURE 4.36

Affected Federal Aquatic Resource Areas; Millers River: Non-River-Tunnel Alternative

Charles River Crossing DSEIS/R



FIGURE

4.38

State Wetlands Areas

Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 50 100 200 FEET



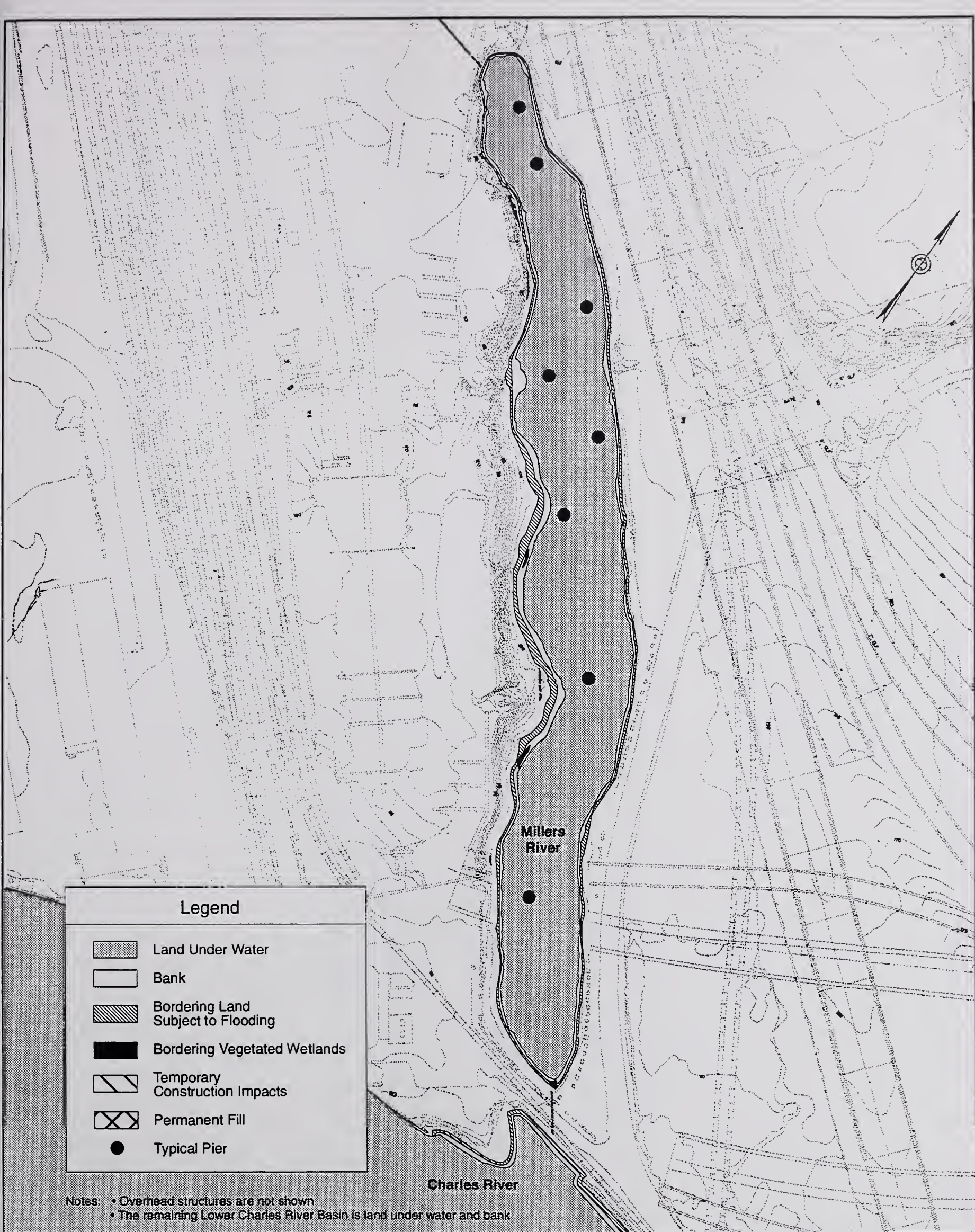


FIGURE
4.39

**Affected State Wetlands Areas;
Millers River:
Scheme Z**

Charles River Crossing DSEIS/R

MASSACHUSETTS HIGHWAY DEPARTMENT
CENTRAL ARTERY/TUNNEL PROJECT

0 50 100 200 FEET



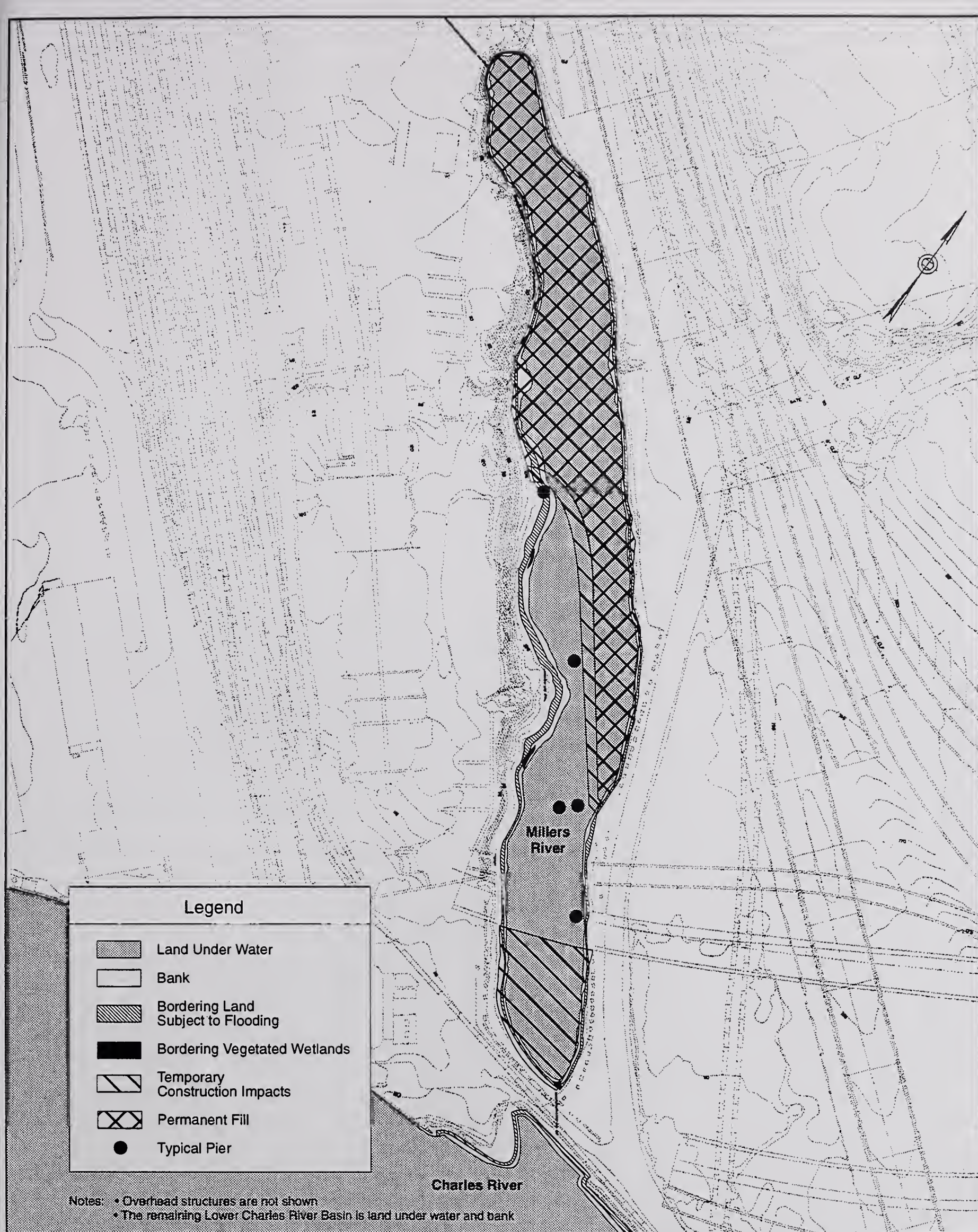


FIGURE
4.40

**Affected State Wetlands Areas;
Millers River:
Alternative 8.1D Mod 5
Charles River Crossing DSEIS/R**

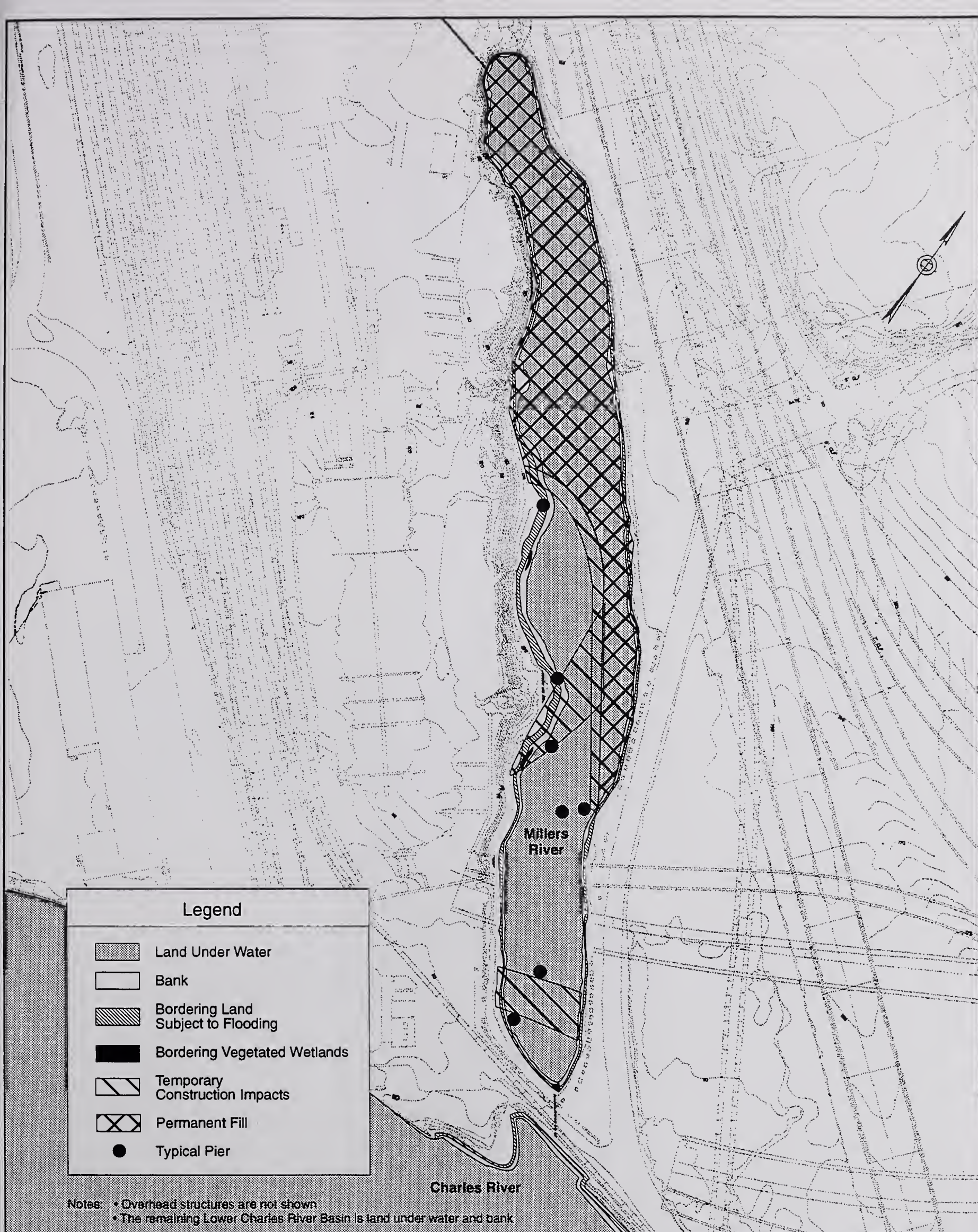


FIGURE
4.41

**Affected State Wetlands Areas;
Millers River:
Reduced River-Tunnel Alternative
Charles River Crossing DSEIS/R**



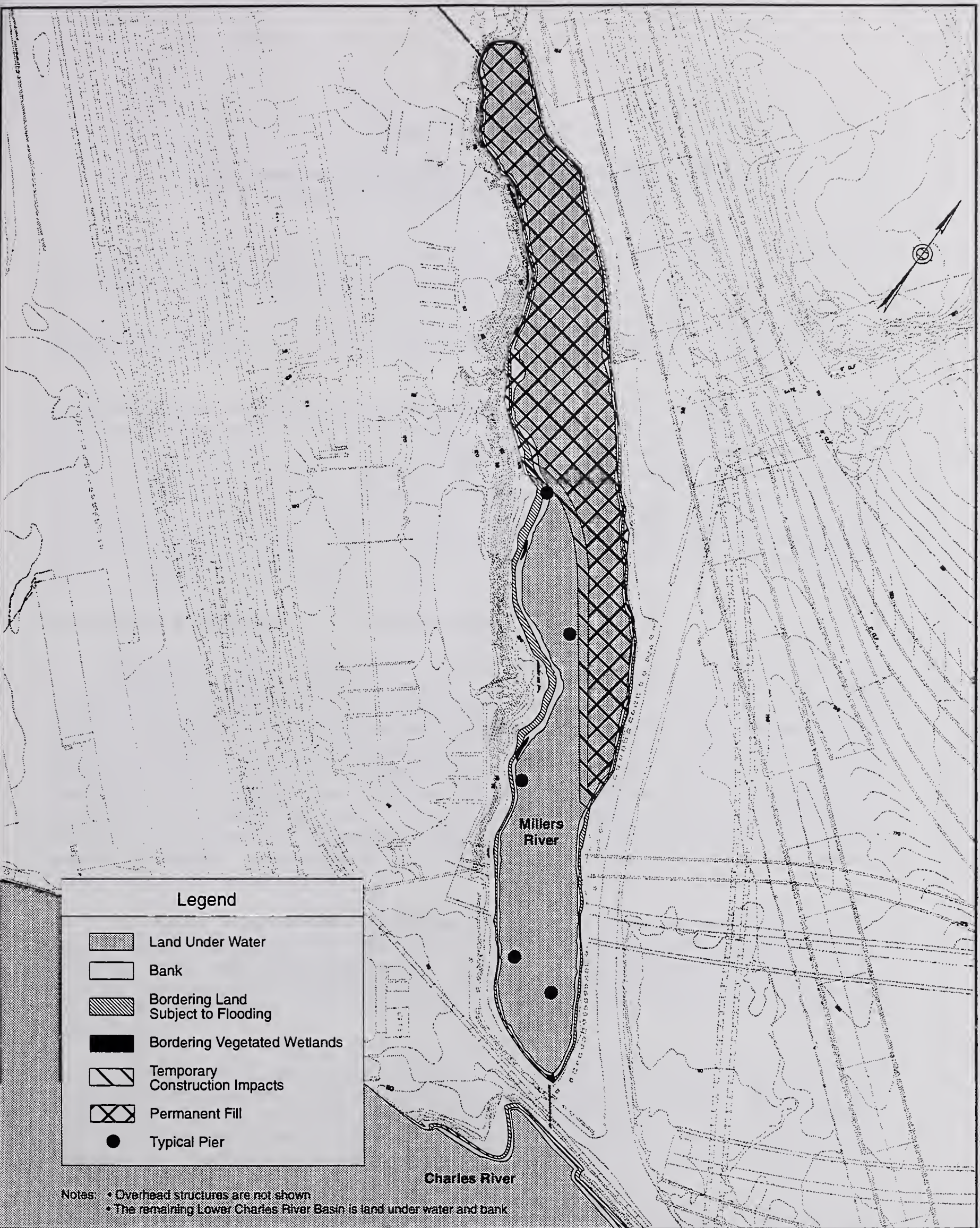


FIGURE 4.42

**Affected State Wetlands Areas;
Millers River:
Non-River-Tunnel Alternative
Charles River Crossing DSEIS/R**



Scope of Work

Supplemental Environmental Impact Statement Revised Charles River Crossing

A third supplemental environmental impact statement (SEIS) is required for the above referenced project.

Project Limits. The geographic area covered in this SEIS is roughly the same as in the Area North of Causeway Street in the FSEIS.

Charles River Crossing Options Considered. The Draft SEIS will compare refinements to two design options with the FSEIS Proposed Action: a non river tunnel option, based on improvements to the FSEIS Proposed Action (Scheme Z); and a Charles River tunnel option, based on improvements to the Notice of Project Change design (ie, Scheme 8.1D mod 5). A preferred option will be indicated in the Draft SEIS. After the Public Hearing on the Draft SEIS, a preferred option will be compared to the FSEIS Proposed Action in the Final SEIS.

Technical Analyses To Be Undertaken.

1) **Land Use.** The impacts of the I-93 northbound off-ramp to New Rutherford Avenue on Bunker Hill Community College, on the industrial district to its north and on the residential community across New Rutherford Avenue in Charlestown will be evaluated. The impacts of new displacements, particularly the Spaulding Rehabilitation Hospital and Boston Thermal Minot Station, will be evaluated including the future reuse of portions of parcels not required for highway use. In addition, the joint development impacts on property owned by Massachusetts General Hospital along Nashua Street, including the Spaulding Rehabilitation Hospital site, will be evaluated.

2) **Cultural Resources.** Changes to historical and archaeological resources in this project subarea will be reevaluated, according to Section 106 of the National Historic Preservation Act. Of particular interest are the Registry of Motor Vehicles Building at 100 Nashua Street, the Bullfinch Triangle and Tower A (railroad facility).

3) **Traffic and Transportation.** The design year for traffic predictions remains the same as in the FSEIS. Traffic data to be provided will be in the same categories and format as in the FSEIS. The methodology used for the traffic analysis will be clarified for reviewers, including advice on how to interpret tables and charts.

The study area traffic network will be extended north along the I-93 corridor to north of the Mystic Avenue interchange. This will provide more precise data regarding the split of traffic between

the expressway and local street approaches to the Charles River crossing from the north. Additional intersections in Charlestown and east Cambridge will be analyzed. Finally, the surface route options available to trucks carrying hazardous materials will be reevaluated and a recommendation will be made.

The Leverett Circle intersection design aspects, traffic signalization, access to Nashua Street from Charles Street Extension, pedestrian paths, and integration with the MBTA'S Green Line Science Park station, will be further analyzed. In addition, due to the lack of improvement to the traffic level of service at the Leverett Circle/Storrow Drive intersection and the lack of safety and operational improvements, additional studies will be conducted to arrive at a final recommendation for the design of this intersection.

Available information from the North Station-South Station rail link study being undertaken by the Federal Transit Administration will be evaluated as to the effect on the Area North of Causeway Street design. The effects of the highway design options on the rail alternatives will be evaluated with the FTA. In particular, the alternatives FTA is studying will be evaluated to make certain the Central Artery/Tunnel Project in this subarea does not preclude future rail link development. The impacts of the river tunnel will be reviewed with FTA. FTA will be a cooperating agency in this SEIS.

An evaluation on the human factors of driving through tunnels will be conducted to provide new information for tunnel design consideration. FHWA is concerned with driver behavior and its impacts on traffic operations and safety. Tunnels, in general, present a higher operational risk than surface facilities because of their confined environment. Therefore, the costs and behavior risks associated with the tunnels will be identified.

4) Air Quality. A detailed air quality assessment will be undertaken to confirm that the Revised Charles River Crossing including new ventilation building (s), will comply with the requirements of the 1990 Clean Air Act Amendments, the Massachusetts State Implementation Plan, and the Massachusetts Ventilation Building certification regulation. The feasibility and cost effectiveness of a single ventilation building will be evaluated. In addition, a ventilation system containing two buildings for Alternative 8.1.D.mod 5 will be evaluated.

5) Noise and Vibration. The monitoring sites that were analyzed for the SEIS Proposed Action in the Area North of Causeway Street will be reevaluated. Additional sites will be selected for noise monitoring, prediction of future noise monitoring, and prediction of future noise levels in areas which would be potentially affected by the Revised Charles River Crossing.

Operational vibration is not an issue. However, baseline vibration levels will be measured at critical structures.

6) Aquatic Resources. Pursuant to the Massachusetts Wetlands Protection Act, the Massachusetts Chapter 91 process, and the U.S. Army Corps of Engineers (USACE) Section 404 regulations the impacts on wetlands and waterways due to a new tunnel in the Charles River, construction of an adjacent grading basin and a tunnel section storage area will be evaluated further.

The Revised Charles River Crossing concept will be submitted to the USACE to trigger the Highway Methodology review that will be used to select the least damaging practicable alternative for the design elements affecting aquatic resources in the Charles and Millers Rivers. Measures to avoid or minimize impacts will evolve from this process resulting in final design.

FHWA and the USACE are concerned with the impacts of the tunnel crossing the Charles River proposed under the alternative 8.1.D.mod 5. Accordingly, this scope allows refinements to the alternatives. The object is to reduce the aquatic impacts within the Charles River Basin and provide the least environmentally damaging practical alternative. A refinement to be studied will be an alternative that does not include a river tunnel and its associated additional material disposal.

Mitigation measures for impacts to the Millers River will be developed in conjunction with regulatory agencies. The impact of additional construction in waterways and historic filled tidelands (i.e., Chapter 91) will be reevaluated.

7) Materials Disposal. Boring data of subsurface conditions will be developed in order to estimate relationships between characteristics of excavated and dredged material and suitable disposal sites.

8) Construction Impacts. The key construction impact areas will be reevaluated.

9) Section 4 (f) Evaluation. The Final Section 4 (f) Evaluation in the FSEIS will be reevaluated and revised, as appropriate, due to changed impacts to parklands and historic resources.

The mitigation program will be reevaluated and revised to reflect new or reduced impacts because of the RCRC or other optional design.

10) Value Engineering. A Value Engineering Study will be performed on the highway design options. It will be performed at an appropriate stage before the SFEIS is published.

Use of the BHCC athletic field and jogging track by the general public renders it eligible for protection under Section 4(f).

All comparisons relate to the Scheme Z, except where one new alternative is explicitly compared to another.

3.1 Scheme Z And New Design Alternatives Considered In The 1993 DSEIS/R

Scheme Z includes two five-lane long-span bridges and one six-lane, medium-span, double-deck bridge over the Charles River, a two-way viaduct behind North Station connecting to Leverett Circle, and an interchange on the north bank of the river consisting of six nested loop ramps up to 105 feet high and tangent to the river's edge.

Alternative 8.1D Mod 5 has a single 10-lane long-span bridge, a three-lane river tunnel with a ventilation building on each side of the river, and a single loop ramp 35 to 40 feet high and 180 feet from the river's edge.

The Reduced River-Tunnel Alternative has a single 12-lane long-span bridge, a two-lane river tunnel with a ventilation building on each side of the river, and two loop ramps 35 to 40 feet high and 140 feet from the river's edge.

The Non-River-Tunnel Alternative has a 10-lane long-span bridge, a four-lane, medium-span, single-deck bridge with the same profile as the mainline bridge, no river tunnel, a ventilation building for land-based tunnels south of the river, and three ramps merging to two loop ramps 35 to 40 feet high and set back 140 feet from the river's edge.

3.2 Leverett Circle/Storrow Drive (Charles River Esplanade)

Description Of Section 4(f) Property. The Leverett Circle/Storrow Drive intersection is an area of approximately 1 acre lying within the southeastern boundary of the historic Charles River Reservation, a 1,000-acre public parkland including the Charles River and land on both sides of the river between the old Charles River dam (O'Brien Highway) and Watertown to the west. The Boston portion of the Reservation lying between Storrow Drive and the Charles River is called the Esplanade. The portion of the Esplanade park near Leverett Circle is heavily used and contains a pedestrian/bicycle path, a swimming pool, a wading pool, a baseball field, a football/soccer field, a tot-lot, and, closest to the Project area, two tennis courts. An historic building at the MDC dam currently housing a State Police station, and a parking area are located adjacent to Leverett Circle.

Although Storrow Drive was developed as a riverside parkway within the Charles River Reservation, its terminus at Leverett Circle has been modified over the years to accommodate heavy general traffic volumes. Leverett Circle is a landscaped traffic rotary at the intersection of Storrow Drive, O'Brien Highway, Nashua Street, Lomasney Way, Martha Road, and the approach ramps to the Central Artery (see Figure 2). The Green Line Science Park ~~Line~~ light rail transit station owned by the MBTA is located on an elevated structure that bisects the Circle. Two pedestrian bridges over Storrow Drive and Leverett Circle link the station with the Charles River Park private housing development and the Charles River Esplanade riverside park. Pedestrian access to the approximately 28,000-square-foot grassy area within the Circle is not available as it would be unsafe to cross the heavily travelled roadway that surrounds it. Peak hour traffic volumes on Storrow Drive, Nashua Street, and O'Brien Highway that feed into Leverett Circle are among the highest in the Central Business District. A westbound two-lane underpass at Leverett Circle carries traffic from I-93 and the Tobin Bridge to Storrow Drive, and two

by the Reduced River Tunnel Alternative (1.28 percent), and the Non-River-Tunnel Alternative (0.85 percent).

Electrical Consumption. Annual electrical energy consumption requirements for tunnel ventilation, drainage, and roadway lighting in the Project subarea has been estimated and is summarized in Table 4.43-4.44. Scheme Z has the lowest annual energy requirement for electrical systems (11,950 Btus) because it involves the shortest distance of roadway in tunnel. Alternative 8.1D Mod 5 has the highest electrical consumption requirements at 76,540 million Btus, followed by the Reduced River-Tunnel and Non-River-Tunnel Alternatives at 37,880 and 28,330 million Btus, respectively.

Total Direct Energy Consumption. Total annual direct energy requirements are projected to be highest under Scheme Z at 2,312,220 equivalent barrels of oil. Of the three alternatives, 8.1D Mod 5 results in the lowest direct energy requirements at 2,270,100, a 1.5 percent decrease from Scheme Z. The Reduced River-Tunnel Alternative results in a 1.09 percent savings from Scheme Z, at 2,286,930 Bbl, while the Non-River-Tunnel Alternative results in a 0.73 percent savings at 2,295,310 Bbl.

4.10.2(b) Indirect Energy Analysis: Construction Energy

The analysis of construction energy quantifies and compares the amount of energy required to construct all Project infrastructure in the Area North of Causeway Street under Scheme Z and the three new design alternatives. For the purpose of this analysis, the length of all new structures associated with the different alternatives has been divided into the total number of lane miles constructed at grade, on elevated structures, in boat section and in tunnel. Construction energy requirements are then derived by multiplying these lengths by Btu per line-mile figures, which quantify the amount of energy necessary to construct various types of roadway. The construction energy requirements for the alternatives are summarized in Table 4.44-4.43. Although Scheme Z has the shortest lane-mile total in the Area North of Causeway Street, it has the highest construction energy requirement at 332,857 Bbl; because relatively little of the alignment is constructed at grade. Instead, most roadways in Scheme Z are on elevated structures, which are much more energy-intensive to build. The construction energy requirements for the three alternatives are relatively similar, ranging from a low 320,450 Bbl for the Reduced River-Tunnel Alternative to a high of 326,980 Bbl for the Non-River Tunnel Alternative.

4.10.3 Conclusion

An energy analysis indicates that Scheme Z has both the highest direct and indirect energy requirements. As a result, implementation of any of the three new design alternatives under consideration results in energy savings. The 1991 FSEIS/R concluded that the direct energy savings realized under Scheme Z when compared to a future no-build scenario compensates for construction energy requirements in approximately 7 years. Implementation of any of the three new design alternatives under consideration results in a shorter pay-back period. Of the four designs, Alternative 8.1.D Mod 5 results in the largest energy savings when compared to Scheme Z, followed closely by the Reduced River-Tunnel Alternative and the Non-River-Tunnel Alternative, respectively.

4.11 RELATIONSHIP OF LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

This chapter discusses in general terms the relationship of local short-term impacts and the use of resources and long-term productivity for Scheme Z, Alternative 8.1D Mod 5, the Reduced River-Tunnel Alternative, and the Non-River-Tunnel Alternative, respectively.

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Table 4.43

ANNUAL DIRECT ENERGY CONSUMPTION

	Scheme Z	Alternatives		
		8.1D Mod 5	Reduced River-Tunnel	Non-River-Tunnel
Motor Vehicles				
Annual vehicle miles traveled	1,823,486,000	1,795,676,000	1,800,282,000	1,808,734,000
Gallons consumed:				
Gasoline	92,521,130	90,560,360	91,320,540	91,713,870
Diesel	10,016,620	9,876,980	9,895,750	9,946,850
Total	102,537,750	100,437,340	101,216,290	101,660,720
Btus consumed (millions)	13,400,020	13,125,990	13,227,390	13,285,520
Electrical systems (for ANOCs subarea only)				
Btus consumed (millions)	11,950	76,450	37,880	28,330
Total direct energy consumption				
Btus consumed (millions)	13,411,970	13,202,440	13,265,270	13,313,850
Bbl consumed	2,312,220	2,276,100	2,286,930	2,295,310

1 gallon gasoline = 130,000 Btus
 1 gallon diesel fuel = 137,000 Btus
 1 barrel crude oil = 5,900,000 Btus (average for all crudes)
 1 kilowatt-hour = 3,413 Btus

Fuel Consumption Standards: FHWA
 Conversion Sources: United States Department of Energy
 FHWA

Note: One British thermal unit (Btu) is quantity of energy necessary to raise one pound of water one degree Fahrenheit.

Source: Bechtel/Parsons Brinckerhoff

Table 4.44

CONSTRUCTION ENERGY REQUIREMENTS

Design	Lane-miles in ANOCS subarea	Btus consumed (billions)	Bbl consumed
Scheme Z	16.35	1,930	332,860
8.1D Mod 5	16.63	1,874	323,020
Reduced River-Tunnel	17.54	1,859	320,450
Non-River-Tunnel	19.06	1,897	326,980

